The Effect of Safety Management Systems on Compliance with Occupational Health and Safety Protocols Among Construction Workers

Hasni Riyas Alfina, Desiran Sembiring, Suryawan Murtiadi

Program Studi Magister Teknik Sipil, Institut Sains Dan Teknologi Nasional, Jakarta, INDONESIA

E-mail: hriyas12@gmail.com, demuham@gmail.com, suryawan@istn.ac.id

| Submitted: August 26, 2025 | Revised: October 09, 2025 | Accepted: May 16, 2026 |

| Published: May 29, 2026 |

ABSTRACT

In construction project management, creating a supportive work environment through adequate facilities, safe working conditions, and two-way communication between superiors and subordinates is a primary objective. This study aims to analyze the influence of safety culture on workers' compliance with safety signage, as well as the impact of the Occupational Safety and Health Management System (SMK3) on adherence to OHS protocols and project performance in the Nuansa Cilangkap Flats construction project, East Jakarta. The research adopts an explanatory method with a quantitative approach, hypothesis testing, and fishbone diagram analysis. The independent variables include SMK3/regulations, top management commitment, OHS rules and procedures, communication, worker competence, worker involvement, and the work environment, while the dependent variable is project performance. Findings indicate that project performance is influenced by these factors, collectively contributing 55.4% ($R^2 = 0.554$). Internal factors such as awareness of PPE usage and education level, along with external factors such as the enforcement of sanctions, further strengthen OHS implementation. The study also reveals that SMK3 has been implemented in accordance with Government Regulation No. 50 of 2012, achieving a 93.5% "satisfactory" rating, although further improvements are needed to achieve optimal results.

Keywords: safety culture, K3 compliance, construction projects, SMK3, project performance.

INTRUDUCTION

Occupational Safety and Health (OHS) issues are now a major concern in various organizations because they involve aspects of humanity, law, social responsibility, institutional image, and cost efficiency (Ervianto, 2005). Optimal implementation of OHS not only protects workers, but also contributes to increased productivity, work quality, and accident reduction [1]. However, in the high-risk construction sector, the number of work accidents remains high due to the suboptimal implementation of OHS standards and procedures. Safety culture is seen as a key factor in increasing worker compliance with OHS protocols [2]. Although several studies emphasize the importance of leadership, management policies, communication, and worker involvement as factors in forming a safety culture [3], field practices still show limitations. Obstacles that arise include low awareness among top management, weak development of organizational culture, and the lack of new approaches in human resource management, especially in the early stages of the project. This has created research related to the extent to which safety culture directly influences worker compliance in implementing OHS protocols in construction projects. Regulations such as the Minister of Public Works Regulation [4] and the Minister of Manpower Regulation No. PER.05/MEN/1996 emphasizes the importance of implementing an Occupational Safety and Health Management System (SMK3). However, its implementation in construction projects, particularly high-rise buildings, still faces challenges in terms of worker compliance and the effectiveness of safety culture. Therefore, this study urgently examines the influence of safety culture on worker compliance and SMK3 implementation, using a case study of the Nuansa Cilangkap Flats (Rusun Nuansa) construction project in East Jakarta. This study can contribute to strengthening the implementation of OSH in the high-risk construction sector.

pISSN 2302-4240
eISSN 2655-2086
Volume 15, Issue 2, June 2026, pp.0520-0530
DOI: http://dx.doi.org/10.32832/astonjadro.v15i2.21368 http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO

Problem Formulation. Based on the explanation in the background section, the main research questions can be formulated as follows: 1) How do safety management system factors influence the performance of the Nuansa Cilangkap Flats (Rusun Nuansa) construction project in East Jakarta? 2) How does the implementation of SMK3 on OSH compliance affect safety protocols in the Nuansa Cilangkap Flats (Rusun Nuansa) construction project in East Jakarta? 3) How does project performance improve with OSH implementation in the Nuansa Cilangkap Flats (Rusun Nuansa) construction project in East Jakarta?

RESEARCH METHODS

This research is an explanatory study that aims to test hypotheses and explain the causal relationship between variables, where one variable is suspected to influence another. Using a quantitative approach, this study explores the influence of several factors on project performance, such as the implementation of the Occupational Health and Safety Management System (SMK3), top management commitment, compliance with OHS procedures, communication, worker competence, workforce involvement, and work environment conditions. As a tool to identify potential causes of problems, a fishbone diagram is used. Data were obtained using a one-time survey method (cross-sectional) through questionnaires distributed to workers at the Nuansa Cilangkap Flats development project in East Jakarta. In this study, the data used consisted of primary and secondary data. Primary data were obtained directly from workers involved in the Nuansa Cilangkap Flats Development Project in East Jakarta, with the aim of comprehensively describing the level of awareness and supervision of the culture of compliance with OHS protocols. Data collection was carried out using an approach designed to ensure the accuracy of the results and strengthen the findings. The following is the research hypothesis shown in Figure 1.

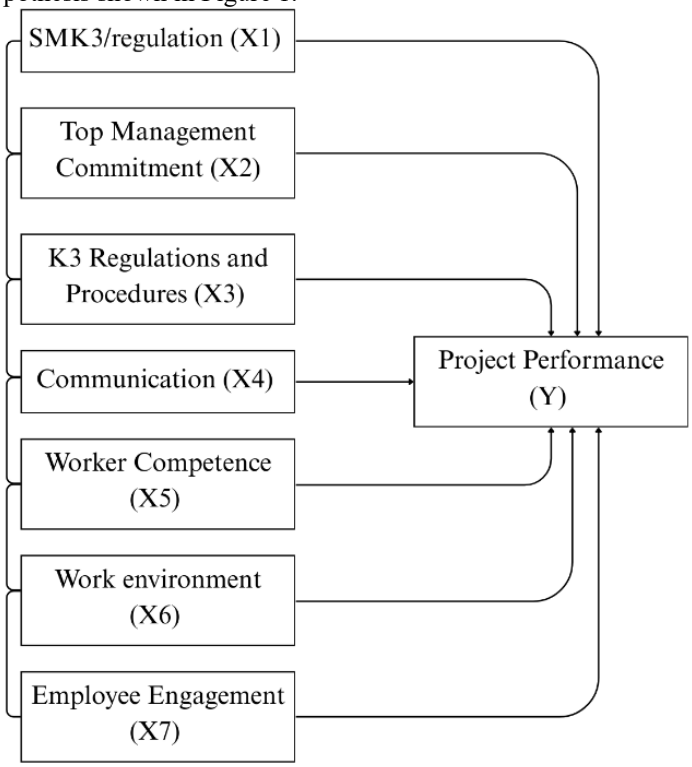

Figure 1. Research Hypothesis

Data Analysis Technique

This study employed a survey method, collecting data through questionnaires completed directly by each respondent. The goal was to explore individual perceptions of the variables studied. The data analysis process was conducted using Statistical Package for the Social Sciences (SPSS) software,

which serves as a tool for quantitative analysis. Furthermore, a fishbone diagram visualization technique was used to identify the root causes of the problem. In the context of this study, the dependent variable was project performance, while occupational safety culture was categorized as the independent variable.

Research Flowchart

The following diagram outlines the research implementation stages to ensure the process is directed and follows procedures. Figure 2 shows the research flowchart regarding the influence of safety culture on the level of compliance with OHS protocols in the Nuansa Cilangkap Flats construction project, East Jakarta.

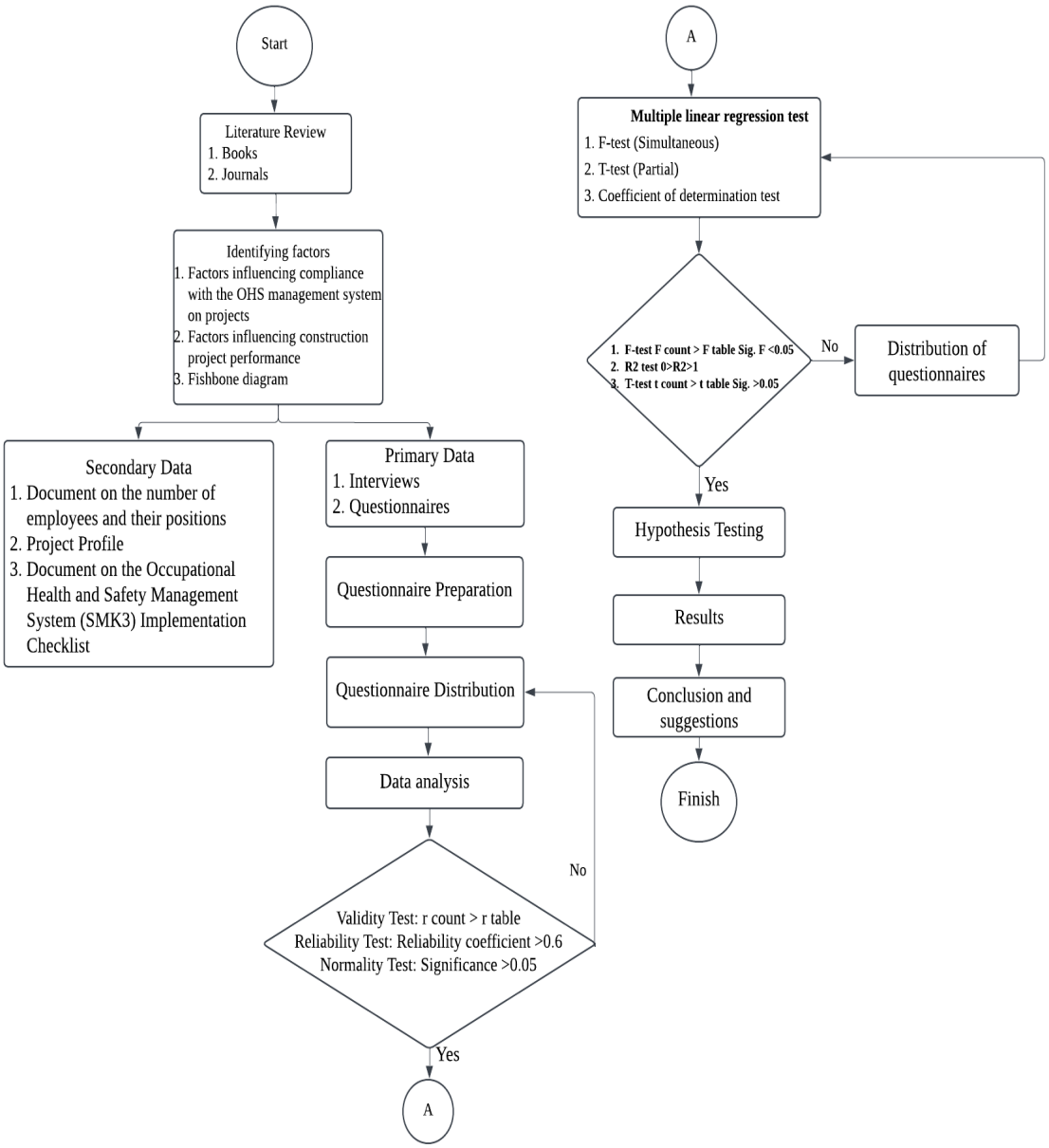

Figure 2. Research flow diagram

pISSN 2302-4240
eISSN 2655-2086
Volume 15, Issue 2, June 2026, pp.0520-0530
DOI: http://dx.doi.org/10.32832/astonjadro.v15i2.21368 http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO

RESULTS AND DISCUSSION

The Nuansa Cilangkap Flats development project in East Jakarta involved 300 people, including construction experts, field staff, and administrative support. Based on calculations using the Slovin formula, the number of respondents used in this study was 75. Respondent characteristics analyzed included age, educational background, position, and work experience in the construction sector. All data were obtained through the distribution of questionnaires to predetermined respondents.

1. Respondent Age

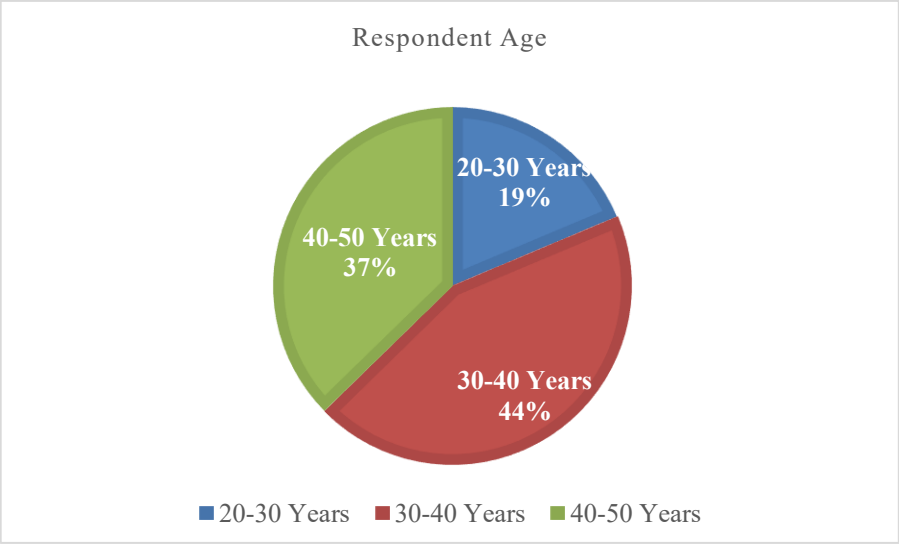

Figure 3. Respondent Age

Based on the data displayed in the pie chart in Figure 3, the age distribution of workers in the Nuansa Cilangkap Flats project in East Jakarta is as follows: 19% (14 people) are between 20 and 30 years old, 44% (33 people) are between 30 and 40 years old, and 37% (28 people) are between 40 and 50 years old. This finding indicates that the majority of the workforce involved is in the productive age category.

2. Last education

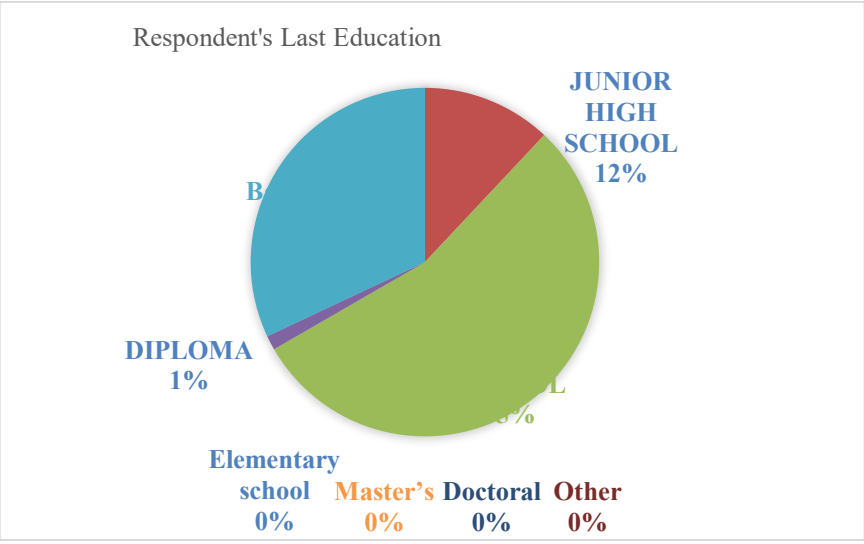

Figure 4. Last Education

The pie chart data in Figure 4 shows that the highest education level of employees on the Nuansa Cilangkap Flats project in East Jakarta was junior high school (12%) (9 field workers), high school (55%) (25 field workers, 4 foremen, 3 deputy foremen, 3 site administration officers, 1 architectural officer, 5 surveyors, and 1 drafter), D3 (1 commercial officer), and S1 (32%) (project manager, 1 quality assurance and quality control officer, 2 quality control officers, 1 SHE officer, 1 administration and safety officer, 2 safety officers, 1 site engineer, 3 engineering officers, 1 commercial officer, 4 procurement and equipment officers, 1 project, document and administration controller, 1 site administration officer, 1 main site administration officer, 1 production administrator, 2 MEP officers, and 1 main MEP officer). The majority of respondents in the Nuansa Cilangkap Flats project in East Jakarta had a high school (SMA) or bachelor's degree (S1) education. This indicates that the workforce involved in the project has a high level of education.

3. Respondents' Positions

Table 1. Respondents' Positions

Position	Total	Percentage
Project Manager	1	1%
Quality Assurance and Quality Control	1	1%
Quality Control	2	3%
Safety, Health, and Environment	1	1%
Admin and Safety Officer	1	1%
Safety Officer	2	3%
Site Engineering	1	1%
Engineering	3	4%
Commercial	2	3%
Procurement and Equipment	4	5%
Project Controller and Document & Contract Administration	1	1%
Surveyor	5	7%
Drafter	1	1%
Architectural Executor	1	1%
Site Administration Lead	1	1%
Site Administration Lead	3	4%
Production Admin	1	1%
MEP Lead	1	1%
MEP Executor	2	3%
Deputy Foreman	3	4%
Foreman	4	5%
Field Worker	34	45%
Total	**75**	**100%**

Based on Table 1, respondents' positions include project manager, quality assurance and quality control, safety, health, and environment, administration and safety office, site engineering, project controller and document & contract administration, drafter, architectural implementer, main SA (site administration) implementer, production administrator, main MEP implementer (1%), quality control, safety officer, commercial, MEP implementer (3%), engineering, site administration implementer (4%), procurement and equipment (5%), surveyor, deputy foreman (4%), foreman (5%), and field worker (45%). This means that of the 75 construction workers on the Nuansa Cilangkap Flats project in East Jakarta, the majority of respondents are implementers or field workers.

3. Length of Service on Construction Projects

pISSN 2302-4240
eISSN 2655-2086
Volume 15, Issue 2, June 2026, pp.0520-0530
DOI: http://dx.doi.org/10.32832/astonjadro.v15i2.21368 http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO

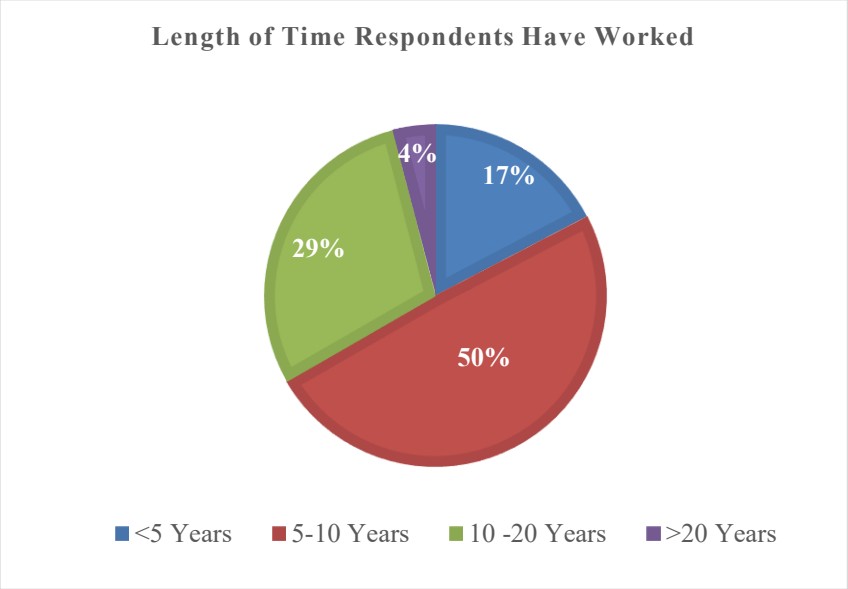

Figure 5. Length of Service on Construction Projects

Based on the data analysis shown in Figure 5, the majority of respondents, 49% (37 people), had between 5 and 10 years of work experience. Twenty-two (29%) respondents had 10 to 20 years of service, while 13 respondents (17%) had less than 5 years of experience, and only 3 (4%) had more than 20 years of service. These findings indicate that the majority of the project workforce has adequate experience, indicating a good understanding of operational procedures, work risks, and accident prevention measures at the project site.

Occupational Safety and Health Management System (OSHMS) Impacts Construction Project Performance

The results of the t-test indicate that the implementation of the Occupational Safety and Health Management System (OSHMS) has a significant and positive impact on project performance. This is indicated by a significance value (sig-t) of 0.019, which is less than the 0.05 level of significance. Based on these results, H1 is accepted and H2 is rejected. These findings indicate that the better the implementation of the Occupational Health and Safety Management System (SMK3), the higher the performance of the resulting construction project. In the Nuansa Cilangkap Flats construction project in East Jakarta, the implementation of the SMK3 is reflected in workers' compliance with personal protective equipment (PPE), understanding of emergency procedures, ability to recognize potential hazards, and active reporting of incidents and potential risks at the work site. Furthermore, high-risk work is regulated through standard operating procedures (SOPs) that are consistently developed and implemented. Interviews with Safety, Health, and Environment (SHE) personnel confirmed that the implementation of the SMK3 on this project follows the principle of the hierarchy of risk control, encompassing elimination, substitution, engineering, administrative control, and the use of PPE. Supervision of PPE use is carried out routinely every day during operational hours. However, one challenge faced is maintaining workers' consistency in using PPE according to regulations. Project management demonstrates a strong commitment to the implementation of K3 through the provision of adequate safety facilities, active supervision, and the implementation of a policy of temporarily stopping work activities if significant potential hazards are found. This policy reflects management's responsibility to ensure the safety and health of workers during construction.

Top management commitment influences construction project performance.

T-test results indicate that top management commitment significantly influences construction project performance, with a significance value of 0.010 < 0.05, thus H2 is rejected and H2 is accepted. The stronger the management commitment, the greater the chance of project success, consistent with research by Maufiq (2021) [6]. In the Nuansa Cilangkap Flats construction project,

commitment was demonstrated through the temporary suspension of high-risk work, routine OHS evaluations, safety training, and the provision of PPE. Interviews with the SHE indicated that OHS communication was conducted consistently every morning, covering safety, cleanliness, and the 5R project targets. Dominant OHS procedures included the use of PPE, work area cleanliness, and participation in Tool Box Measuring (TBM). Supervision was carried out not only through rule enforcement but also through coaching, accompanied by regular training to increase worker awareness. These efforts are expected to reduce workplace accidents and create a safe, orderly, and productive project environment.

OHS regulations and procedures influence construction project performance.

The results of the T-test analysis indicate that the implementation of OHS policies and procedures significantly influences construction project performance, with a significance value of $0.025 < 0.05$, thus rejecting H_0 and accepting H_3. This confirms that project success can be improved through the consistent implementation of occupational safety policies and protocols, in line with the findings of Maufiq (2021). Interviews with the SHE team at the Nuansa Cilangkap Flats project in East Jakarta confirmed that OHS regulations were implemented according to standards, and workers felt they were beneficial in fostering awareness and work vigilance. OHS regulations and procedures serve as operational guidelines to reduce accidents, provide safe work guidelines, and reflect project discipline. Its implementation has been proven to improve not only safety but also productivity and project performance, reinforced by ongoing management outreach using simple language for easy worker understanding.

Worker communication impacts construction project performance.

T-test results indicate that the communication variable has a positive and significant effect on project performance with a significance value of $0.049 < 0.05$, thus rejecting H_0 and accepting H_4. This means that the better the communication within the project, the higher the performance achieved, in line with the findings of Maufiq (2021). Interviews with SHEs revealed that communication is implemented through safety instructions, safety talks, weekly meetings, briefings, and toolbox meetings, which contain information on potential hazards and safe work procedures. Clear and timely communication has been shown to improve worker understanding of risks, strengthen work relationships, reduce misunderstandings, and expedite decision-making. Thus, effective communication not only supports safety aspects but also drives efficiency, productivity, and project performance achievement.

Worker competence influences construction project performance.

T-test results indicate a positive and significant relationship between workforce competence and project performance, with a significance value of $0.011 < 0.05$, thus rejecting H_0 and accepting H_5. This means that increasing worker competence is directly proportional to improving project performance, consistent with research by Maufiq (2021). Interviews with the SHE revealed that the Nuansa Cilangkap Flats project regularly conducts OHS training, including working at heights using full-body harnesses. Workers also proactively seek guidance from supervisors or the OHS team when they do not understand procedures, reflecting efforts to improve competency for safety. Worker competence has been shown to play a crucial role in reducing the potential for accidents, increasing productivity, maintaining work quality, and is key to the success of construction projects.

The environment influences construction project performance.

The T-test results indicate that the work environment significantly influences project performance with a significance value of $0.002 < 0.05$, thus H_0 is rejected and H_6 is accepted. This means that the better the work environment, the more optimal project performance, in line with the findings of Maufiq (2021). Interviews with SHE and workers at the Rusun Nuansa Cilangkap project revealed that working conditions were generally good, although there were still challenges in terms of commitment for some workers. A clean, safe, and comfortable work environment supported by an OHS culture has been shown to increase motivation, procedural compliance, and productivity, thus directly contributing to project success.

Worker engagement influences construction project performance

pISSN 2302-4240
eISSN 2655-2086
Volume 15, Issue 2, June 2026, pp.0520-0530
DOI: http://dx.doi.org/10.32832/astonjadro.v15i2.21368 http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO

The T-test results indicate that worker engagement has a positive and significant effect on project performance with a significance value of 0.016 < 0.05, thus H_0 is rejected and H_7 is accepted. This means that the higher the worker engagement, the better the project performance, in line with the findings of Maufiq (2021). Interviews with the SHE at the Nuansa Cilangkap Flats project revealed that workers were involved from the planning through to the implementation of the OHS program and actively enforced regulations, including issuing warnings or stopping work if violations occurred. This participation fosters a strong safety culture, increases discipline in the use of PPE, and fosters shared responsibility. Thus, worker involvement contributes significantly to reducing the risk of accidents while ensuring the project meets the targeted quality, time, and cost targets.

Implementation of the Occupational Health and Safety Management System (SMK3) in the Nuansa Cilangkap Flats Development Project, East Jakarta

After obtaining the percentages for the five aspects of the OHS Management System (SMK3) implementation in the Nuansa Cilangkap Flats project, East Jakarta, the overall results of the SMK3 implementation in the Nuansa Cilangkap Flats project are shown in Table 2.

Table 2. Summary of SMK3 Implementation Results

No.	Description	Percentage Results	Value	Remarks
1	OHS Policy	83,3%	2	Fairly Good
2	OHS Planning	100%	3	Very Good
3	OHS Implementation	96,9%	3	Very Good
4	OHS Performance Monitoring and Evaluation	87,5%	3	Very Good
5	OHS Performance Review and Improvement	100%	3	Fairly Good
	TOTAL Percentage	**93,5%**	**3**	**Satisfying**

(Source: Personal data processing results, 2025)

To illustrate the level of implementation of the five basic principles of the OHSMS in the project, the percentage results are visualized in the form of a bar chart, as shown in Figure 6.

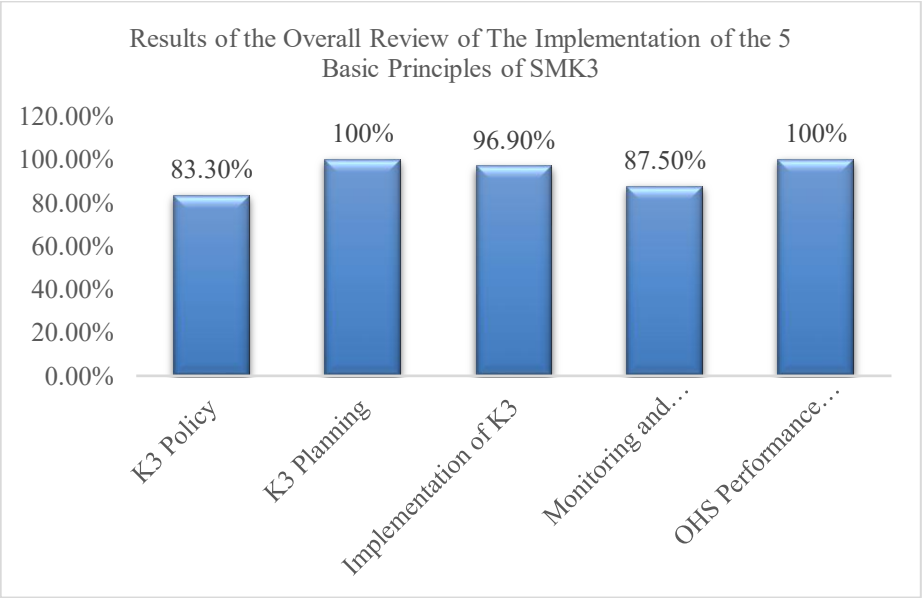

Figure 6. Results of the Overall Review of Occupational Health and Safety Management System (SMK3) Implementation

Based on the data summary presented in Table 2 and Figure 6, the level of implementation of the SMK3 in the construction activities of the Nuansa Cilangkap Apartments project in East Jakarta shows an overall achievement of 93.5%. Referring to the evaluation criteria stipulated in Government Regulation No. 50 of 2012, this score is categorized as "satisfactory." The evaluation of SMK3 implementation shows that the establishment of OSH policies has reached 83.3%, demonstrating management's commitment to occupational safety. Overall OSH planning has achieved 100%, demonstrating thorough and structured planning. In terms of field implementation, OSH implementation reached 96.9%, indicating that operational activities have largely proceeded according to plan. Monitoring and evaluation of OSH performance achieved a score of 87.5%, indicating fairly effective oversight. Meanwhile, the aspect of OSH performance review and improvement also showed a perfect achievement of 100%, reflecting optimal implementation.

Fishbone diagram

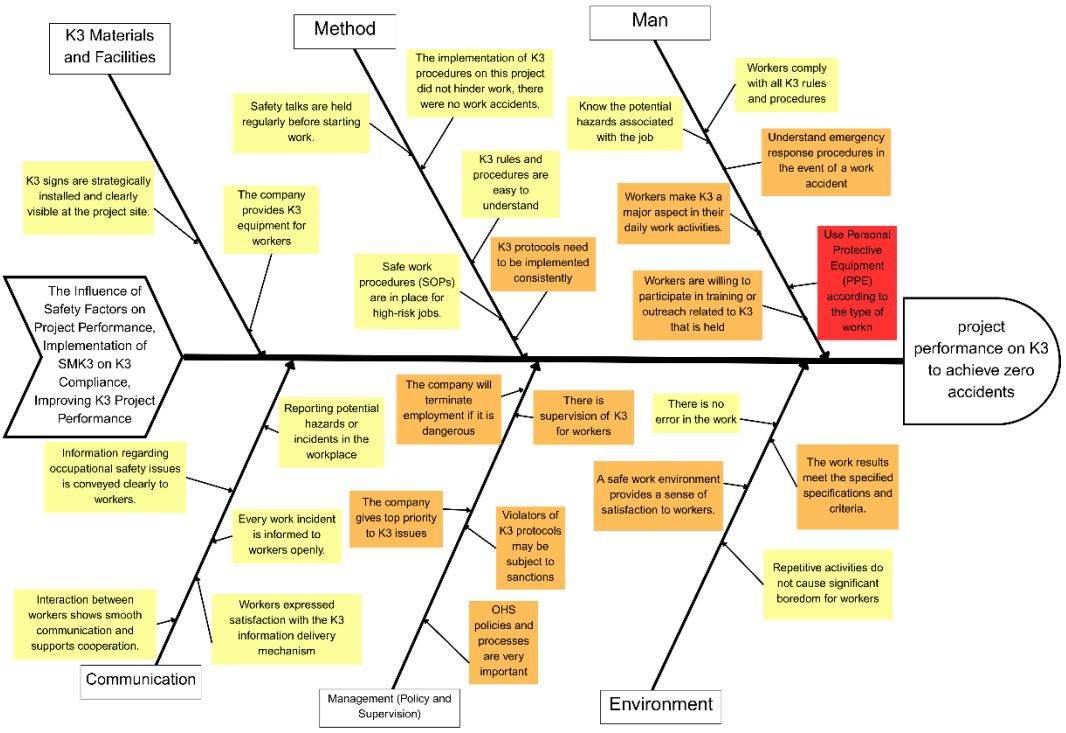

Figure 7. Fishbone analysis results

The fishbone analysis in Figure 7 shows that project performance in terms of OHS to achieve zero accidents is influenced by six main factors: OHS materials and facilities, work methods, people, communication, management, and the work environment. The availability of adequate PPE and facilities, the implementation of SOPs and safety talks, worker compliance, clear communication, management commitment, and a safe work environment are key to successful OHS implementation. All of these factors are interrelated, so weaknesses in any one of them can increase the risk of accidents. With consistent integration, a culture of occupational safety can be achieved sustainably.

CONCLUSION

Factors influencing safety culture on project performance include the OHS Management System (SMK3), top management, OHS rules and procedures, communication, worker competence, the work environment, and worker involvement. The magnitude of the influence includes SMK3/Regulation 0.333, top management 0.333, rules and procedures 0.234, communication 0.259, work competence 0.264, work environment 0.367, and worker involvement 0.304. The R^2 value of 0.554 indicates that the independent variable influences project performance by 55.4%, the remaining 44.6% is influenced by other factors. The success of project performance is also supported

by awareness of the use of PPE, worker education, and the application of sanctions as external factors. The Nuansa Cilangkap Flats development project in East Jakarta has implemented SMK3, including the determination of K3 policies, K3 planning, K3 implementation, monitoring and evaluation of K3 performance, review, monitoring and improvement of K3 as mandated by PP No. 50 of 2012. However, the level of implementation still requires improvement to achieve fully optimal results. This is reflected in the achievement of the implementation of the 5 basic principles of SMK3 reaching 93.5%, which according to the classification in PP No. 50 of 2012 is in the satisfactory category. The results of the fishbone analysis indicate that achieving zero accidents in projects is influenced by six main factors: OHS materials and facilities, work methods, people, communication, management, and the work environment. Consistent integration of all these factors is key to building a sustainable occupational safety culture.

REFERENCES

[1] Maddeppungeng, A., Asyiah, S., & Prasetyo, F. (2022). Pengaruh Kontraktor Dan Kondisi Lingkungan Terhadap Bahaya Kesehatan Dan Keselamatan Kerja (K3) Di Proyek The Canary Apartement. Fondasi: Jurnal Teknik Sipil, 11(1), 44-55.

[2] Al-Bayati, A. J., Choudhry, R. M., & Zahoor, H. (2021). Impact of construction safety culture and construction safety climate on safety behavior and safety motivation. Safety, 7(2), 41. https://doi.org/10.3390/safety7020041

[3] Berglund, N., Rasmussen, H. B., & Mearns, K. (2023). Exploring safety culture research in the construction industry. Work: A Journal of Prevention, Assessment &Rehabilitation, 76(3), 1089–1100. https://doi.org/10.3233/WOR-220214

[4] Kementerian Pekerjaan Umum Republik Indonesia. (2008). *Peraturan Menteri Pekerjaan Umum Nomor 09/PRT/M/2008 tentang Pedoman Sistem Manajemen Keselamatan dan Kesehatan Kerja (SMK3) Konstruksi Bidang Pekerjaan Umum*. Jakarta: Kementerian Pekerjaan Umum.

[5] Kementerian Tenaga Kerja Republik Indonesia. (1996). *Peraturan Menteri Tenaga Kerja Republik Indonesia Nomor PER.05/MEN/1996 tentang Sistem Manajemen Keselamatan dan Kesehatan Kerja (SMK3)*. Jakarta: Kementerian Tenaga Kerja RI

[6] Muafiq, R. (2021). Pengaruh Budaya Keselamatan Dan Kesehatan Kerja (K3) Terhadap Kinerja Proyek Konstruksi. Jurnal Teknik Sipil Dan Teknologi Konstruksi, 7(1), 27-39.

[7] Pemerintah Republik Indonesia. (2012). Peraturan Pemerintah Republik Indonesia Nomor 50 Tahun 2012 tentang Penerapan Sistem Manajemen Keselamatan dan Kesehatan Kerja. Jakarta: Kementerian Sekretariat Negara.

[8] Christina, W. Y., Djakfar, L., & Thoyib, A. (2012). Pengaruh Budaya Keselamatan Dan Kesehatan Kerja (K3) Terhadap Kinerja Proyek Konstruksi. Jurnal Rekayasa Sipil, 6(1), 83-95.

[9] Darmayani, S., Sa'diyah, A., Supiati, S., Muttaqin, M., Rachmawati, F., Widia, C., & Meditama, R. F. (2023). Kesehatan Keselamatan Kerja (K3).

[10] Mael, T. M., & Marica, H. (2025). Pengaruh Penerapan Keselamatan Dan Kesehatan Kerja (K3) Terhadap Kinerja Pada Proyek Pembangunan Gedung Laboratorium Terpadu Kemaritiman Universitas Negeri Gorontalo (UNG). Jurnal Teknik Industri Terintegrasi (Jutin), 8(1), 1422-1432

[11] Pemerintah Republik Indonesia. (1970). Undang-Undang Republik Indonesia Nomor 1 Tahun 1970 tentang Keselamatan Kerja. Jakarta: Kementerian Sekretariat Negara.

[12] Pemerintah Republik Indonesia. (2012). Peraturan Pemerintah Republik Indonesia Nomor 50 Tahun 2012 tentang Penerapan Sistem Manajemen Keselamatan dan Kesehatan Kerja. Jakarta: Kementerian Sekretariat Negara

[13] Yuliawan, K. D., & Laksono, I. (2021). Pengaruh Keselamatan Dan Kesehatan Kerja (K3) Pada Kinerja Pekerja Di Proyek Konstruksi (Studi Kasus: Proyek Pembangunan Gedung The Park Mall Semarang) (Doctoral Dissertation, Universitas Islam Sultan Agung).

[14] Setiono, B. A., & Andjarwati, T. (2019). Budaya Keselamatan, Kepemimpinan Keselamatan, Pelatihan Keselamatan, Iklim Keselamatan Dan Kinerja. Zifatama Jawara.

[15] Mael, T. M., & Marica, H. (2025). Pengaruh Penerapan Keselamatan Dan Kesehatan Kerja (K3) Terhadap Kinerja Pada Proyek Pembangunan Gedung Laboratorium Terpadu Kemaritiman Universitas Negeri Gorontalo (UNG). Jurnal Teknik Industri Terintegrasi (Jutin), 8(1), 1422-1432.